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ABSTRACT

The main purpose of this study was to examine the differences between the pupil-teacher ratio (PTR) and the actual and average class size (CS) at the elementary level in public schools in a single state (Michigan) and to clarify the ramifications for educational leaders. Another purpose of the study was to clarify the referents for the concepts of CS and PTR. The study has seven components: (1) an analysis of existing research and literature; (2) a national pilot study (1998) and followup (2001); (3) the Michigan study (1999); (4) a structured survey (1999) and followup (2002) in an inner-city school district; (5) a multilevel review of CS and PTR at international, national, state, and local levels; (6) a feasibility study to reduce CS in one school district; and (7) an on-site visitation to assess CS and PTR difference in one district (Burke County Schools, North Carolina) and to review Burke County's CS reduction effort. Study results show that at the elementary level there was a difference of about n=9 between a building's average CS and its PTR in Michigan schools. There was a difference of about n=10 at the elementary level in national studies, and a difference of about n=11 in the inner-city studies. In Burke County, a relatively poor county with average K-4 class sizes of 1:14, the difference was about n=5. These data and results of the feasibility study suggest that staffs in many schools could reduce CS at little or no added cost by reexamining the allocation of human and financial resources. Data suggest that at the primary level, students who receive small class treatments (1 teacher to 15 to 18 students) obtain cognitive and affective benefits, and possibly, health related benefits. Data suggest that teachers derive benefits as well. (Contains 20 references.) (Author/SLD)

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AN ANALYSIS OF PUPIL-TEACHER RATIO AND CLASS SIZE: DIFFERENCES THAT MAKE A DIFFERENCE

A Class-size Symposium at the Annual Meeting of the
Mid-South Education Research Association (MSERA)

Chattanooga, TN
November 6-8, 2002

Mark A. Sharp, EdD
Eastern Michigan University
Presenter

Co-presenters:
C.M. Achilles, Eastern Michigan University and Seton Hall University
Paul Egelson and Art Hood, SERVE Laboratory
Sheldon Etheridge, Berkeley County, SC
J. D. Finn, SUNY. Buffalo, NY
Jean Krieger, Woodlake Elementary, Mandeville, LA
Marie Miller-Whitehead, Tennessee Valley Association of Educators

November 7, 2002 11:00-11:50 AM

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ABSTRACT

The main purpose of this study was to examine the difference between the pupil-teacher ratio (PTR) and the actual and average class size (CS) at the elementary level in public schools in a single state (Michigan) in the USA, and to clarify the ramifications of this for educational leaders. Another purpose of the study was to clarify the referents for the two concepts, CS and PTR.

This study consisted of seven components: 1) an analysis of existing research and literature related to CS and PTR; 2) a national pilot study (1998) and a follow-up study (2001); 3) the state of Michigan study (1999); 4) a structured survey (1999) and a follow-up survey (2002) of an inner-city school district; 5) a multi-level review of CS and PTR at the international, national, state, and local levels; 6) a feasibility study to reduce CS in one school district; and 7) an on-site visitation to assess the CS and PTR difference in one district (Burke County Schools, North Carolina) and to review the process that was used in Burke County to reduce CS at the primary level.

Study results showed that at the elementary level there was a difference of about n=9 between a building's average CS and its PTR in Michigan schools. There was a difference of about n=10 at the elementary level in the national studies; a difference of about n=11 in the inner-city studies; and a difference of about n=5 in Burke County, a relatively poor county with average K-4 class sizes of 1:14. The above data and the results of the feasibility study suggest that staffs in many schools could reduce CS at little or no added costs by reexamining the present allocation of human and financial resources.

The data examined by this researcher suggest that at the primary (K-3) level, students who receive small class treatments (one teacher to 15 to 18 students) obtain cognitive, affective, and possible health-related benefits. The data suggest that teachers derive benefits as well. This study clearly showed that CS and PTR are not the same and, therefore, should not be used as synonyms.

Introduction

The use of a clear referent when discussing or defining a concept, idea, theory, proposition, or object is critical to understanding and the ability to discuss it clearly, concisely, objectively, and intelligently. Referents and descriptors for class size (CS) and pupil-teacher ratio (PTR) are extremely important. Clarification of the concepts would contribute significantly to the ongoing debate about the effect that CS has on student achievement, and the potential costs of class-size reduction (CSR). Additionally, many conclusions about the effects of CS on student achievement at the primary school level have been made using data generated from PTR studies conducted in the upper grade levels (Betts, 1996). Generalizations about the effects of CS on the achievement of primary-age students from elementary and secondary-level PTR data may be invalid.

Scientific studies on the effects of CS on student achievement were conducted in the 1980s and 1990s and showed improved student achievement (e.g. Prime Time, 1984-1986; STAR, 1985-1990, SAGE, 1995-2002). This paper summarizes a study done by Sharp (2002) that examined and compared CS and PTR and helps to clarify issues surrounding CS, PTR, and achievement. Confusion about and possible misuse of these terms may be promoting: a) inequities and inequalities in education, b) uncertain or punitive policy, and c) poor decisions by school administrators and boards of education.

Statement of the Problem

Educators are constantly looking for school improvement initiatives that will have positive benefits for the highest number of students at the lowest cost to the district. CSR, directed at the primary level (K-3), has been placed on center stage. Debated at the

local, state, and national levels, the issue is extremely complex in that it has short and long-range political, economic, and educational implications. Central in this debate is clarity between the two concepts, CS and PTR. How similar or different are these terms? Does one, neither, or both influence student outcomes positively, and to what degree?

Surprisingly, little attention has been given in this debate to the definitions and use of the terms PTR and CS. Are they often used interchangeably and therefore incorrectly? The problem for this study was the apparent conflict between CS and PTR.

Purpose of the Study

The main purpose of this study was to examine the difference between the PTR and the actual CS at the primary level (K-3) in a single state. Another purpose of the study was to clarify the referents for the two concepts, CS and PTR. The researcher sought answers to the following research questions to achieve the study's purpose.

Research Questions

1. What, if any, are the differences between PTR and actual class sizes as described in:
    a) publications, literature, research, and databases?
    b) elementary schools in the U.S.?
    c) an actual sample of school systems in a single state?
    d) a large urban school district?
2. How might a district implement a CSR initiative using existing resources, and what steps might a district follow to reduce CS at a minimum cost?

The researcher also addressed some ancillary questions and issues to help clarify CS/PTR issues. Secondary questions included:

3. What are the possible positive benefits of:

    a) clarifying the concepts of PTR and CS?
    b) developing standard definitions for the two concepts?
    c) comparing outcomes of CS and PTR changes separately?

4. How do discussions of these differences:

    a) hinder or facilitate policy decisions at the local, state, and national levels?
    b) hinder or facilitate decision making in school districts and buildings?

5. What are the implications for policy makers and educational leaders?

Significance of the Study

Clarifying the concepts of CS and PTR could bring more precision in propositions that use these two concepts. These terms are often used as synonyms, and the data analyses of one concept are often misused to draw conclusions about the effects of the other concept. Policy makers, researchers, and school administrators have used the conclusions drawn from the effects of PTR and achievement as a basis for their lack of support for, and often their opposition to, reduced CS.

Study results could benefit researchers, policy makers, and practitioners by:

1. bringing focus to the debate on the effects of CS on student achievement by clearly defining the terms CS and PTR and their outcomes,

2. promoting the need for additional research on CS, and PTR as separate concepts,

3. highlighting the implications for traditional intervention programs (i.e. Title I, special b education, etc.),

4. helping to promote funding of present class-size initiatives,

5. demonstrating problems of generalizing about CS from PTR data,

6. promoting increased class-size initiatives and the importance of careful assessment of those initiatives,

7. assisting school administrators and staff in decisions related to class-size initiatives and to PTR interventions,

8. illuminating the difficulty of collecting accurate CS and PTR data.

Summary of the Methods

The researcher conducted a review of research and literature related to PTR and CS to determine the consistency in the use of these two terms. Data obtained from U.S. Department of Education reports, and other sources, were used to make comparisons between the various levels examined in this study (i.e., local, state, national). This study incorporated both quantitative and qualitative methods.

The researcher examined international, national, and state data to determine what differences (if any) exist between CS and PTR and to demonstrate the levels of consensus and confusion that surround PTR and CS.

A pilot study employing a convenience sample in 12 states was used to obtain initial CS and PTR data and to refine a survey instrument. The researcher used this survey to examine CS and PTR in one state (Michigan), a sample of schools in one large inner-city district, and one Southeastern school district, to determine actual differences between PTR and CS. Data on PTR were compared to class-size data.

A feasibility study was conducted in a single school district to determine if reducing class size (K-3) was possible using existing district funds. In addition, this researcher visited a Southeastern district to assess the actual process used in that CSR initiative.

Delimitations of the Study

In this study, the researcher:

- examined CS in public schools in Michigan; this did not include charter or private schools.
- studied only the K-3 grade levels.
- whenever possible relied upon reported data that were available in statistical reports rather than collecting data anew.

Limitations of Study

- The random sampling of CS in K-3 classrooms in Michigan public elementary schools limits the ability to make valid generalizations from these data to other levels in public schools in Michigan.
- Generalizations cannot be made to states using aggregated national PTR and CS averages.
- Generalizations cannot be made about CS and PTR conditions in other states using Michigan PTR and CS data.
- Valid generalizations cannot be made to other districts using Burke County School District's PTR and CS data.

Definitions of Relevant Terms

The following is a list of terms and definitions that are important in this study.

Average Class Size – This is derived by dividing a unit's (i.e., grade level, building, etc.) total student enrollment by the number of regular classroom teachers.

Churning - The coming and going of students and adults throughout the school day and throughout the school year (Monk, 1992).

Class Size (CS) - The number of children listed on a regular education teacher's attendance book and for whom the teacher is responsible.

Effect Size (ES) - The size of the treatment effect is the number of standard deviations the experimental population mean is from the true population mean.

Production Function - The achievement level of an individual school or district related to costs and other inputs (Boozer & Rouse, 1995).

Pupil-Teacher Ratio (PTR) – Pupil-teacher ratio is the total student enrollment (in a district or school) divided by the total number of certified staff (McRobbie et al., 1998).

Regular Classroom Teacher - A certified teacher who teaches in traditional DK-12th grade classrooms.

Support Teacher - Any certified teacher who supports the regular program (e.g., Title 1, resource room, or other special education classroom teachers, and teachers of projects, or who teach in specific areas such as music, gifted, etc.).

Hypothesis

Based upon the confusion in the existing literature and research, both in definitions of CS and PTR and in the available conflicting results of analyses using these terms, the following hypothesis was the primary challenge for the study. Two subsidiary hypotheses are described later.

H1: There is a measurable difference in "actual" and "average" class size (CS) as compared to the building PTR in public schools.

Research Design and Methods

This study contained both quantitative and a qualitative components. One portion of the study was a survey. The researcher used seven separate approaches in this investigation. These seven areas include:

1. Analyses of existing research and literature.
2. A national pilot study (1997-98) and a national follow-up study (2001) related to CS and PTR.
3. A structured, random survey related to CS and PTR in a single state (Michigan).
4. A structured, random survey (1998) of one large inner-city school district and a follow-up survey (2002).
5. Analyses of data comparing PTR to CS in schools at varying levels (i.e., international, national, state, and local).
6. A case study to model how CS can be reduced using existing building revenue.

7. Examination and analysis of a low-wealth district in a Southeastern state that had reduced CS (Avg. n=14) in grades 1, 2, and 3 district-wide at little or no extra costs.

Variables for the Study

This study involved making comparisons between two concepts (PTR and CS) to determine where differences existed between the two, and how large the differences were. The two concepts can be thought of as variables.

Survey Handling Procedures

1. the initial mailing to a random sample (n=300) of elementary schools
2. another mailing three weeks later to principals who had not responded,
3. and the mailing of another survey a week later (response rate 54%).

Data Handling and Analysis Procedures

Using the data provided on the returned survey instrument, the researcher calculated the PTR for each site and determined the average PTR for all buildings involved in the study. The same procedure was followed to determine CS averages for individual buildings, the average for all buildings, and also the average for each grade level involved in the study (K-3). The data were examined and verified. Grade-level means from the survey were compared to international, national, state, and district PTRs. The researcher described differences in PTR and CS at each level of analysis.

Descriptive and comparative analyses were used to interpret the data in both the quantitative and the qualitative components of this study. These results were then recorded (written, tabled, or graphed).

Data Collection Procedures

A survey assured that a uniform data collection procedure was maintained in this study. Surveys were mailed to the sample of elementary principals in early 1999. A survey was cost-effective and provided a quick means of retrieving data. Sites were selected randomly, thus allowing for generalizations to be made to the total population of K-3 classrooms in public schools in Michigan. Because of the large geographic area being surveyed, mailings were a practical means of gathering the data. The same survey was used in the national pilot study, in the inner-city school district study, and in the Burke County, North Carolina, study.

Recommendations for Future Research and Study

At this point, it seems reasonable to interject areas for future study. This study showed both the complexity of the CS/PTR debate and the actual numerical differences of these concepts. Research in the following areas may help to bring additional focus to this debate:

- Conduct similar surveys of CS and PTR at the primary (K-3) level in other states to determine the differences between and within states.
- Conduct studies and make comparisons of PTR and CS at the upper-elementary, middle-school, and high-school level in Michigan, and in other states and countries.
- Conduct studies on PTR and CS in different types of school districts and compare the findings (i.e., rural, small city, suburban, urban, and inner-city).
- Improve the evaluation components of future CS and PTR studies (i.e., collect pre-test data as well as post-test). Take analyses down to the building, class, and student levels.
- Incorporate better use of research design and methodology (such as that used in the STAR study).

Policy makers (i.e., legislators, board members, etc.) should push for the collection of actual and average CS data at the district (local), state, and national levels in addition to collecting PTRs at these levels. This would allow for the viewing of the whole picture and would provide data showing the actual conditions related to enrollment and staffing in the schools. Working with these data would allow for better assessment of programs and staff assignment.

Study Results

H1: There is a measurable difference in "actual" and "average" CS as compared to the PTR in public schools.

H1 Response: Yes. These differences are about n=9 in Michigan (elementary only level); about n=10 in the 1998 National Pilot Study (elementary only level); about n=10 in the 2001 National Follow-up Study (elementary only level), about n=10 in the 1999 inner-city study (elementary only level), about n=12 in the 2002 inner-city follow-up study (elementary only level); and about n=5 (K-5 level) and about n=2 (grades 1-3) in Burke County, NC.

The results (at all levels) support the research hypothesis for this study. The state study provides empirical data with a 90% confidence level and a sampling error of 10% or less. Results in all components of the study supported that it is possible to reduce CS by reallocating staff and resources. The literature review suggests that CSR, directed at the primary grade level (K-3), is a viable means to improve schooling outcomes, such as to increase student test-score achievement, reduce student in-grade retention, and improve student discipline. The literature review found affective benefits derived by students and teachers as a result of being in classrooms with fewer students (Glass & Smith, 1978; Smith & Glass, 1979; Bloom, 1984; Word et al., 1990; Achilles, Nye, & Zaharias, 1995; Finn & Achilles, 1999; Sutton, 2000; Terry, 2002). In addition to the

cognitive and affective benefits of CSR, Prout (2000) found that there are health benefits for both students and teachers from being in small classes.

Finally, based on the findings of this study, this researcher explored two other hypotheses. Additional study and research is necessary to extend the responses.

H2: As class size decreases, student achievement and other outcomes increase.

H2 Response: Yes. Results of earlier studies related to CS and achievement (K-3) suggest that students in small classes (around 15) outperform students in regular size classes (around 24). There are also affective, health, and long-term benefits (e.g., adult earnings, increased graduation rates from high school, improved attendance, etc.) associated with being in small classes.

H3: As PTR becomes "more" favorable, student achievement and other outcomes increase.

H3 Response: According to the research related to a "more" favorable PTR (around 15:1), and student achievement and other outcomes, there is no significant relationship. This is because a more favorable PTR does not assure reductions in CS.

Conclusions, Discussion, and Recommendations

This study found important differences between the two concepts, PTR and CS; the two terms do *not* mean the same thing. A review of the literature found that many researchers and policy makers use the two terms as synonyms and regularly juxtapose the two concepts. For example, in a policy perspective, Wenglinsky (1997) used the terms as synonyms throughout his discussion. His conclusions, however, do support and call for CSR.

Although the main emphasis of this study was the elementary level, related data consistently showed a difference between CS and PTR throughout K-12. Because one viable strategy to reduce CS is through reallocation of existing human and financial

resources, school leaders do not have to rely solely on outside or additional support to begin to address this important school reform measure. In fact, this measure may produce more efficient and effective use of funds by redirecting existing funds and personnel before new monies are obtained. Miles (1995) explained why: "Although educators often argue for more funds and critics counter that school spending is already too high, neither group has looked systematically at the use of existing resources" (p. 496). This reality should compel school leaders to rethink the traditional use of staff and to re-allocate human and financial resources to bring down *actual* CS to the effective ranges demonstrated in long-term research. Research supports a reduction in pull-out programs such as those found in many Title 1 projects (e.g., McDill & Natriello, 1997; Abt, 1997; Borman & D'Agostino, 1996), phasing out the use of classroom aides (e.g., Gerber, et al., 2001; Word et al., 1990) staffing to use the benefits of small K-3 classes (such as a reduction in need for remedial projects) could provide added classrooms and teachers (Achilles & Sharp, 1998).

The results of this study's comparison of CS and PTR are clear: The two concepts are not the same. They should not be used as synonyms. These important findings should help to refocus the CS and PTR debate.

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